

Nina Miolane, Ph.D.

 [ninamiolane](#) |  [ninamiolane](#) |  [@ninamiolane](#) |  [@ninamiolane.bsky.social](#)
 [ninamiolane.com](#) |  ninamiolane@ucsb.edu |  +1.415.244.1603

SUMMARY

My research sits at the intersection of mathematics, artificial intelligence, and neuroscience. I study the *geometry of intelligence*: the mathematical rules that govern how brains and machines organize, transform, and adapt information to make sense of the world. Using these rules, I design next-generation AI that succeeds where most models fail—delivering up to +66% higher accuracy or the same accuracy with 10× faster models—even when datasets are small, noisy, or complex (*e.g.*, networks, and 3D shapes). I employ my models to build digital twins of the brain—integrating imaging, cognition, and molecular data to forecast brain health, detect disease early, and support personalized care. Breakthroughs from my research are regularly featured in the media.

EDUCATION

- 2018-2021 Postdoctoral Fellow and Lecturer in Statistics at **Stanford University** (U.S.)
🏆 *Inria Silicon Valley Postdoctoral Fellowship (ranked 1st)*
🏆 *Stanford University's CONNECT award*
🏆 *1st Prize (\$100,000) in the C3.ai Covid-19 Grand Challenge*
- 2013-2016 Ph.D. in Geometric Statistics at **Inria & Stanford University** (France, U.S.)
🏆 *France-Stanford Center for Interdisciplinary Studies Fellowship (ranked 1st)*
🏆 *Inria S-Cordi National Fellowship (ranked 1st)*
🏆 *1st Prize at MICCAI Educational Challenge, MIT, Boston*
🏆 *L'Oréal-Unesco For Women in Science National Prize (ranked 1st computer scientist)*
- 2012-2013 MSc. in Mathematical Physics at **Imperial College London** (U.K.)
- 2010-2012 BSc. and MSc. in Mathematics and Physics at **Ecole Polytechnique** (France)
- 2008-2009 Classes Préparatoires in Mathematics at **Ecole Sainte Genevieve (Ginette)** (France)

WORK EXPERIENCE

- Assistant Professor, UC Santa Barbara (UCSB)** 2021 - present
– Principal Investigator, [Geometric Intelligence Lab](#): Lead team of 14 researchers
– Director of the [REAL AI for Science Initiative at UCSB](#)
– Director of the [AI Core of the Bowers Women's Brain Health Initiative](#)
– 🏆 *Complete Awards List*
- Senior Software Engineer, Atmo, San Francisco** 2020 - 2021
– Built large-scale AI for weather forecasting.
– 🏆 *Awarded TIME Best Invention of the Year*
- Software Engineer, Caption Health, San Francisco** 2017 - 2018
– Built intelligent ultrasound probe for cardiac imaging.
– 🏆 *1st FDA-approved AI-powered medical device*
- Lieutenant in the French Army, RSMA Martinique, France** 2009 - 2010
– Led platoon of 20 soldiers
– 🏆 *Decorated in two-week commando training in the rainforest*

GRANTS

2025. Anonymous Gift. REAL AI for Science	(lead PI, \$500k)
2024. Noyce Foundation Gift. AI for Women's Brain Health	(lead PI, \$600k)
2024. Chan-Zuckerberg Initiative Gift. An AI Digital Twin of the Maternal Brain	(lead PI, \$1M)
2023. NSF CAREER: Advancing Shape Learning for Biosciences	(lead PI, \$496k)
2023. NSF. Lie Group Representations for Computational Vision (\$1.2M)	(PI, share: \$500k)
2022. Noyce Initiative UC Partnerships. Leveraging AI to Advance Women's Health	(PI, share \$325k)
2021. NSF. A Deep Learning Framework Using Cell Complex Neural Networks	(PI, share \$400k)
2021. NIH R01. Learning Conformations of Membrane Proteins from Cryo-EM	(lead PI, \$600k)

AWARDS

- Public Voice Fellow of the OpEd project, whose mission is to change who writes history (2025)
- Hellman Fellow (2024)
- TIME Best Invention of the Year (2024)
- UCSB Academic Senate Research Grant (2023)
- NSF CAREER Award (2023)
- UC Regents Junior Faculty Award at UC Santa Barbara (2022)
- PROWESS Fellowship (2022)
- TIME Best Invention of the Year (2021)
- 1st Prize (\$100,000) in the C3.ai Covid-19 Grand Challenge (2020)
- CONNECT award at Stanford University (2019)
- Awarded US Residency in NIW EB2 classification: Alien of Extraordinary Abilities in Science (2018)
- Special Mention in the AFRIF Prize, French Association for Shape Recognition and Interpretation (2018)
- 3rd Prize in 3min thesis competition: Predictive Medicine (2017)
- Medaille Universit Cote dAzur (2016)
- Inria@SiliconValley Postdoctoral Fellowship (2016)
- L'Oreal-Unesco For Women in Science National Prize (11th/1052, 1st computer scientist) (2016)
- Applied Sciences Visiting Fellowship, France-Stanford Center for Interdisciplinary Studies (2014)
- 1st Prize at MICCAI Educational Challenge, MIT, Boston (2014)
- PhD Scholarship, National INRIA S-Cordi (2013)

PRESS

- The Economist, Podcast (upcoming, September 2025).
- Frontiers in Neuroscience, Documentary, Story Co (upcoming, 2025).
- The Current. Leveraging AI to Study Womens Brains During and After Pregnancy. (2025).
- Mind Over Matter Podcast: Geometric Intelligence with Dr. Nina Miolane. (2024).
- Authority Magazine. Inspirational Women in STEM and Tech: Nina Miolane Of The Geometric Intelligence Lab. (2024).
- Science et Vie. The secrets of our thoughts revealed by the mathematics. (2023).
- The Current. The math of cell movement (2022).
- Ovio. Open Source bridges the gap between mathematical research and industry. (2021).
- This Week in Machine Learning (TWiML) Podcast: Nina: Miolane: Geometric Statistics in Machine Learning w/ Geomstats. (2018).

- Interstices, Inria. The mathematics of space-time that describe and go beyond the brain. (2017).
- NVIDIA webinar. How AI is transforming Healthcare. (2017).
- TVFIL78: Research: She wants to challenge the status quo. (2017).
- Le Monde. Binaire. Miolanes anatomy. (2017).
- Spirou Magazine. Brain research: inside the labs. (2017).
- France Inter, National Radio. Podcast: Le Club de la Tte au Carre. (2016).
- RTL2 Podcast. A Nicoise researchers work receives top honors. (2016).
- TVFIL78 Daily Show: Nina Miolane: Awardee of the LOreal-Unesco For Women in Science Fellowship.(2016).
- France 3 Azur. She receives the LOreal-Unesco For Women in Science Fellowship for her research. (2016).
- Les Editions Select. (2016).
- 78actu. Spotlight on a clear-thinking researcher. (2016).

TEACHING AND MENTORING

I teach the following classes at **UCSB**:

- ECE 3: Python Programming for Science and Engineering.
- ECE 278A: Digital Image Processing.
- ECE 594: Geometric, Topological and Equivariant Deep Learning

I taught the following classes at **Stanford University**:

- Introduction to Statistical Methods: Precalculus (2019)
- Statistical Methods for Engineering and the Physical Sciences (2018, 2019)

I take most pride in my **trainees**:

- Ph.D. students: Adele Myers, Mathilde Papillon, Francisco Acosta, Louisa Cornelis, Abby Bertics, Bariscan Kurtkaya, Simon Mataigne.
- Postdocs: Guillermo Gil Bernardez, Sarah Kushner, Fatih Dinc.
- Graduate Interns: Daniel Holmberg, Edouard de Ponnat.
- Luis Pereira (Engineer), Alex West (Manager).

PROJECTS

Neural Manifolds

[Link to Demo](#)

How do brains and AI models structure information? We explore the geometric representations of intelligence, by quantifying the dimensions, topologies, and curvatures of neural manifolds, i.e., the smooth spaces of neuronal activity found in neuronal circuits such as head direction circuits, grid cells, place cells, and areas of visual cortex, and in artificial neural networks layers.

Topological Deep Learning

[Link to Demo](#)

The natural world is full of complex systems characterized by intricate relations between their components: from social interactions between individuals in a social network to interactions between neurons in a neural networks. We develop Topological Deep Learning (TDL) as a comprehensive framework to process and extract knowledge from data associated with these systems.

Equivariant Deep Learning

[Link to Demo](#)

The structures we encounter in data are often governed by hidden symmetries: from the rotational invariance of molecules to the translational patterns of signals. These symmetries can be formalized through mathematical groups, which capture transformations such as shifts, rotations, or rescalings. We develop group-equivariant and *complete* group-invariant neural networks as a principled framework to quotient out these symmetries, while retaining the richness of its other structural information.

OPEN-SOURCE SOFTWARE

Geomstats

[GitHub](#)

- Creator, developer, and organizer of international hackathons
- Organizer of ICLR Computational Geometry & Topology Challenge in [2021](#) and [2022](#)

TopoX

[GitHub](#)

- Co-creator and developer for packages [TopoNetX](#), [TopoEmbedX](#) and [TopoModelX](#)
- Organizer of the ICML Topological Deep Learning Challenge in [2023](#) and [2024](#)

TopoBench

[GitHub](#)

- Developer and senior mentor
- Senior mentor for the TAG 2025 Topological Deep Learning Challenge

SELECTED PUBLICATIONS ([LINK TO FULL LIST](#))

In review

2025

2024

2023

Before 2023

SELECTED TALKS ([LINK TO FULL LIST](#))

2025

- 2025, July 9th. Invited Talk at the Cold Spring Harbor Laboratory Seminar Series. Geometric Intelligence in Minds and Machines.
- 2025, June 18th. Invited Keynote at the UCSB Center for Aging and Longevity. Direct Relief, Santa Barbara. Healthy and Pathological Aging: Unlocking the Brain with AI.
- 2025, June 3rd. Invited Talk at the workshop Bridging Biology and Statistics: Insights and Innovations for Modern Biology In Honor of Professor Susan Holmes. Stanford University.” The Role of AI in Advancing Womens Brain Health.
- 2025, April 30th. Invited Talk at the workshop ”New Developments in the Theory and Methodology of Graph Neural Networks”, NSF-Simons National Institute for Mathematics and Theory in Biology (NITMB), Chicago. Topological Deep Learning.
- 2025, April 2nd. Invited Keynote at the Geometric Intelligence Workshop, Instituto de Matemticas UNAM. Geometric Intelligence in Minds and Machines.
- 2025, March 31st. Invited Keynote at CoSyNe Workshop on GNNs and graphical analysis in neuroscience. A survey of message-passing topological neural networks.
- 2025, February 26th. Invited Keynote at the Center for Brain Health in Dallas. AI and the Digital Twin Brain.
- 2025, February 21st. Invited Keynote at the NeurReps Seminar Series. Geometric Intelligence in Minds and Machines.
- 2025, February 18th. Invited Talk at the Chan-Zuckerberg Initiative. Leveraging AI for Womens Brain Health Research.
- 2025, February 10th. Invited Keynote at the Erwin Schrödinger International Institute. G-Invariance in G-Equivariant Networks.

2024

- 2024, November 14th. Keynote at the Chan-Zuckerberg Initiative Imaging The Future Annual Event. From Nano to Macro: Unlocking the Brain with AI-Driven Imaging Insights.
- 2024, November 9th. Outreach talk at the Lower East Side Girls Club. AI for Womens Brain Health.
- 2024, October 15th. Talk at the Noyce Foundation Annual Event. The Role of AI in Advancing Womens Brain Health.
- 2024, October. UCSB Board of Trustees. AI for Science.
- 2024, August 8th. Invited talk at The Battle of the Metrics Community Event at the Cognitive Computational Neuroscience (CCN2024). MIT, Boston. Riemannian Geometry of Neural Representations in Natural and Artificial Intelligence.
- 2024, July 27th. Keynote at the ICML GRaM Workshop (Geometry-grounded Representation Learning and Generative Modeling). Geometric Intelligence.
- 2024, July 15th. Keynote at the Eresfjord School of Mathematical Methods in Computational Neuroscience. Hierarchical Equivariance in Artificial and Natural Brains.
- 2024, June 18th. Keynote at the CVPR Equivision Workshop on Equivariance in Vision. Hierarchical Equivariance in Artificial and Natural Brains.
- 2024, June 17th. MIT DHIVE Program. Digital Twins and the Role of AI in Advancing Womens Brain Health.
- 2024, May 28th. UC Riverside Seminar. Robust G-Invariance in G-Equivariant Networks.
- 2024, May 22nd. Distinguished Speaker for the Annual Tutte Lecture. Geometric Computations in Natural and Artificial Brains.
- 2024, May 13th. Ann S. Bowers Womens Brain Health Seminar. Digital Twins and the Role of AI in Advancing Womens Brain Health.
- 2024, February 15th. Lie Theory for Vision Grant Colloquium at UC Berkeley Redwood Center for Theoretical Neuroscience. Robust G-Invariance in G-Equivariant Networks.
- 2024, February 13th. Caltechs Math “& Machine Learning Seminar. Robust G-Invariance in G-Equivariant Networks.
- 2024, February 9th. UCSB Physics Graduate Seminar. From theoretical physics to geometric intelligence.
- 2024, January 25th. Workshop of Graph Neural Networks for the Sciences. A survey of message passing topological neural networks.

2023

- 2023, December 8th. Workshop Spatial Data Science in an Age of Scientific Disruption. Keynote: Geometric Artificial Intelligence.
- 2023, November 30th. Harvard University, Department of Applied Mathematics. The Differential Geometry of Neural Manifolds.
- 2023, November 28th. University of North Carolina at Chapel Hill, Applied Physical Sciences Colloquium. Architectures of Topological Deep Learning: A Survey of Topological Neural Networks.
- 2023, November 16th. UC Noyce Initiative’s Launch of the Ann Bower’s Women Brain Health Initiative. Artificial Intelligence for Brain Image Analysis: What Do We Know About the Female Brain?
- 2023, October 6th. Workshop on Multiphysics Measurements and Bayesian Methods. A Survey of Topological Neural Networks.
- 2023, August 17th. MIT Summer School of Geometry. Architectures of Topological Deep Learning: A Survey of Topological Neural Networks.
- 2023, July 18th - Eresfjord School in Mathematical Methods in Neuroscience. Geometry and Topology of Neural Manifolds.
- 2023, June 19th - University of British Columbia. Center for Brain Health. Architectures of Topological Deep Learning: A Survey of Topological Neural Networks.
- 2023, June 18th - CVPR Workshop on Computational Cameras and Displays. Deep Generative Modeling for Volume Reconstruction in Cryogenic Electron Microscopy: A Survey.
- 2023, June 18th - CVPR Workshop on Topology, Algebra and Geometry. (Keynote). Architectures of Topo-

logical Deep Learning: A Survey of Topological Neural Networks.

- 2023, June 8th - Flatiron Institute, Simons Foundation. CryoEM Summer Workshop. Deep Generative Modeling for Volume Reconstruction in Cryo-Electron Microscopy.
- 2023, May 31st - UCLA Applied Mathematics Seminar - Coding Differential Geometry for Machine Learning.
- 2023, May 15th - Ann S. Bowers Womens Brain Health Initiative. Internal Kickoff. Geometric Deep Learning for Neurodegeneration.
- 2023, April 19th - IEEE Central Coast Event Talk - Geometric Learning for Shape Analysis from Bioimaging Data.
- 2023, April 17th - UCSB ECE Summit. Advancing Biomedicine with AI for Shape Analysis.
- 2023, April 15th - UCSB WISE Panels. Women in Science “& Engineering: Academic Careers.
- 2023, February 17th - UCSB Differential Geometry Seminar. Geomstats: coding differential geometry for machine learning.
- 2023, February 17th - UCSB Physics Graduate Seminar. Riemannian Geometry: From General Relativity to Biomedical Imaging.
- 2023, January 31st - Data Science Initiative @ SISSA - Bioshape Analysis with Geometric Learning.
- 2023, January 13th - UCSB Machine Learning Seminar. Geometric Machine Learning.

2022

- 2022, November 16th - UCSB ECE Graduate Seminar. Geometric Machine Learning.
- 2022, November 14th - UCLA ECE Seminar. Shape Learning in Biomedical Imaging.
- 2022, October 11th - INRIA Saclay, Seminar of the SODA / MIND (previously Parietal) teams. Geomstats: A Python Package for Geometry in Machine Learning.
- 2022, October 10th - Workshop Geometry, Topology in Statistics and Data Science of the Thematic Program of Institut Poincaré. Geomstats: A Python package for Geometry in Machine Learning.
- 2022, September 29th - SIAM Conference on Mathematics of Data Science. Mini Symposium of Statistics and Machine Learning in Topological and Geometric Data Analysis. Geomstats: A Python package for Differential Geometry in Machine Learning.
- 2022, September 7th - Geo2Int (Geometry and Geometric Integration) Workshop. Geomstats: A Python package for Differential Geometry in Machine Learning.
- 2022, June 20th - Keynote for the CVPR Deep Learning for Geometric Computing (DLGC) workshop. Shape Learning in Biomedical Imaging.
- 2022, June 8th - University of Washington, eScience Institute Semina and Geomstats Workshop. Geometric Learning for Shape Analysis in Bioimaging.
- 2022, June 1st - Sage Math conference. Geomstats: A Python package for Differential Geometry in Machine Learning.
- 2022, May 6th - Pacific Institute for the Mathematical Sciences (PIMS) workshop. CompSPI: Open-Source Software for Biological Imaging Best Coding Practices.
- 2022, May 2nd - John Hopkins University Center for Imaging Science Workshop. Geometric Learning for Shape Analysis from Bioimaging.
- 2022, April 13th - UCSB, Cryo-EM FIB Forum. Deep Generative Models for Molecular Reconstructions in Cryo-Electron Microscopy.
- 2022, March 11th - Psych “& Brain Sciences Department Seminar. Brain Shapes.
- 2022, March 9th - Computer Science Summit, UC Santa Barbara. Biomedical Shape Analysis with Geometric Learning.
- 2022, February 17th - Invited Lecture, University of British Columbia, Canada. Deep Generative Models for Molecular Reconstructions in Cryo-Electron Microscopy.
- 2022, January 26th - Materials Research Outreach Symposium, UC Santa Barbara. Shape Learning: From Images to Scientific Insights.
- 2022, January 25th - Physics Department Colloquium, UC Santa Barbara. Riemannian Geometry: From General Relativity to Biomedical Imaging.

SERVICE

- Organizer of the WIDS Datathon, Global & University Editions: 6,000+ participants from 99 countries (2025).
- Organizer of the NeurIPS NeuREPS Workshop on Symmetry and Geometry in Neural Representations (2022, 2023, 2024, 2025).
- Organizer of the CVPR 2024 Workshop on Topological Deep Learning for Computer Vision.
- Organizer of the BIRS 2023 Workshop on Mathematical Methods for exploring and analyzing morphological shapes across biological scales.
- Organizer of the MICCAI 2022 Workshop on Topological Data Analysis and its Applications for Medical Data.
- Organizer of the ICLR 2022 Workshop on Geometrical and Topological Representation Learning.
- Organizer of the ICLR 2021 and ICLR 2022 Challenges of Computational Geometry and Topology, and the ICML 2023 and ICML 2024 Challenges of Topological Deep Learning.
- Mentor at Outreachy (2021), at London Geometry in Machine Learning Summer School (2022), and MIT Summer Geometry Institute (2021, 2022).
- Member of the scientific committee of the Conference of Geometric Science of Information (GSI) (2017, 2019, 2021, 2023).
- Organizer of hackathons for geometry in machine learning (2019-2023), see for example SCAI Geomstats Hackathon.

OUTREACH

- Senior organizer of dissemination events to middle schoolers, high schoolers and teachers.
- Lead organizer of REAL AI For Science public lectures, in Santa Barbara and formerly in San Francisco under the names: Curicos and Red Vic Lectures.

MISCELLANEOUS

Languages French, English (fluent), German, Italian, Spanish (conversational), Japanese (beginner)
Hobbies Beach volleyball, aviation (private pilot)